PATENT CLAIMS

1. A method for detecting flash gas in a vapour-compression refrigeration or heat pump system comprising a compressor, a condenser, an expansion device, and an evaporator interconnected by conduits providing a flow path for a refrigerant, c h a r a c t e r i z e d in determining a first rate of heat flow of a heat exchange fluid flow across a heat exchanger of the system and a second rate of heat flow of the refrigerant across the heat exchanger, and using the rates of heat flow for establishing an energy balance from which a parameter for monitoring the refrigerant flow is derived.

2. A method according to claim 1, c h a r a c t e r i z e d in that the heat exchanger is the evaporator.

3. A method according to claim 1, c h a r a c t e r i z e d in that the heat exchanger is the condenser.

4. A method according to one of the claims above, c h a r a c t e r i z e d in establishing the first rate of heat flow by establishing a heat exchange fluid mass flow and a specific enthalpy change of the heat exchange fluid across the heat exchanger.

5. A method according to claim 4, c h a r a c t e r i z e d in establishing the heat exchange fluid mass flow as a constant based on empirical data or on data obtained under faultless operation of the system.

6. A method according to claim 4 or 5, c h a r a c t e r i z e d in establishing the specific enthalpy change of the heat exchange fluid across the heat exchanger based on measurements of the heat exchange fluid temperature before and after the heat exchanger.

7. A method according to one of the claims above, characterized in establishing the second rate of heat flow of the refrigerant by establishing a refrigerant mass flow and a specific enthalpy change of the refrigerant across the heat exchanger.

8. A method according to claim 7, characterized in establishing the refrigerant mass flow based on a flow characteristic of the expansion device, and the expansion device opening passage and/or opening period, and an absolute pressure before and after the expansion device, and if necessary any subcooling of the refrigerant at the expansion device entry.

9. A method according to claim 7 or 8, characterized in establishing the specific enthalpy difference of the refrigerant flow based on registering the temperature and pressure of the refrigerant at expansion device entry and registering the refrigerant evaporator exit temperature and the refrigerant evaporator exit pressure or the saturation temperature of the refrigerant at the evaporator inlet.

10. A method according to one of the claims 1-9, characterized in establishing a residual as difference between the first rate of heat flow and the second rate of heat flow.

11. A method according to claim 10, characterized in providing a fault indicator by means of the residual, the fault indicator being provided according to the formula:

$$S_{\mu_1,i} = \begin{cases} S_{\mu_1,i-1} + s_i, \text{ when } S_{\mu_1,i-1} + s_{\mu_1,i} > 0 \\ 0, \text{ when } S_{\mu_1,i-1} + s_{\mu_1,i} \le 0 \end{cases} \quad (11)$$

where $s_{\mu_1,i}$ is calculated according to the following equation:

$$s_{\mu_1,i} = -k_1\left(r_i - \frac{\mu_0 + \mu_1}{2}\right)$$

where

r_i: residual

k_1: proportionality constant

μ_0: first sensibility value

μ_1: second sensibility value.

12. A flash gas detection device for a vapour-compression refrigeration or heat pump system comprising a compressor, a condenser, an expansion device, and an evaporator interconnected by conduits providing a flow path for a refrigerant, characterized in that the device comprises means for determining a first rate of heat flow of a heat exchange fluid flow across a heat exchanger of the system and a second rate of heat flow of the refrigerant across the heat exchanger, and using the rates of heat flow for establishing an energy balance from which a parameter for monitoring the refrigerant flow is derived, the device further comprising evaluation means for evaluating the refrigerant mass flow, and generate an output signal.

13. A device according to claim 12, characterized in that the means for determining the first rate of heat flow comprises means for sensing heat exchange fluid temperature before and after a heat exchanger.

14. A device according to claim 12 or 13, characterized in that the means for determining the second rate of heat flow comprises means for sensing the refrigerant temperature and pressure at expansion device entry, and means for establishing the pressure at the expansion device exit or the saturation temperature.

15. A device according to one of the claims 12 to 14, characterized in that the means for establishing the second rate of heat flow com-

prises means for sensing absolute refrigerant pressure before and after the expansion device and means for establishing an opening passage or opening period of the expansion device.

16. A device according to one of the claims 12 to 15, characterized in that the evaluation means comprises means for establishing a residual as difference between a first value, which is made up of the mass flow of the heat exchange fluid flow and the specific enthalpy change across a heat exchanger of the system, and a second value, which is made up of the refrigerant mass flow and the specific refrigerant enthalpy change across a heat exchanger of the system.

17. A device according to one of the claims 12 to 16, characterized in that the device further comprises memory means for storing the output signal and means for comparing said output signal with a previously stored output signal.